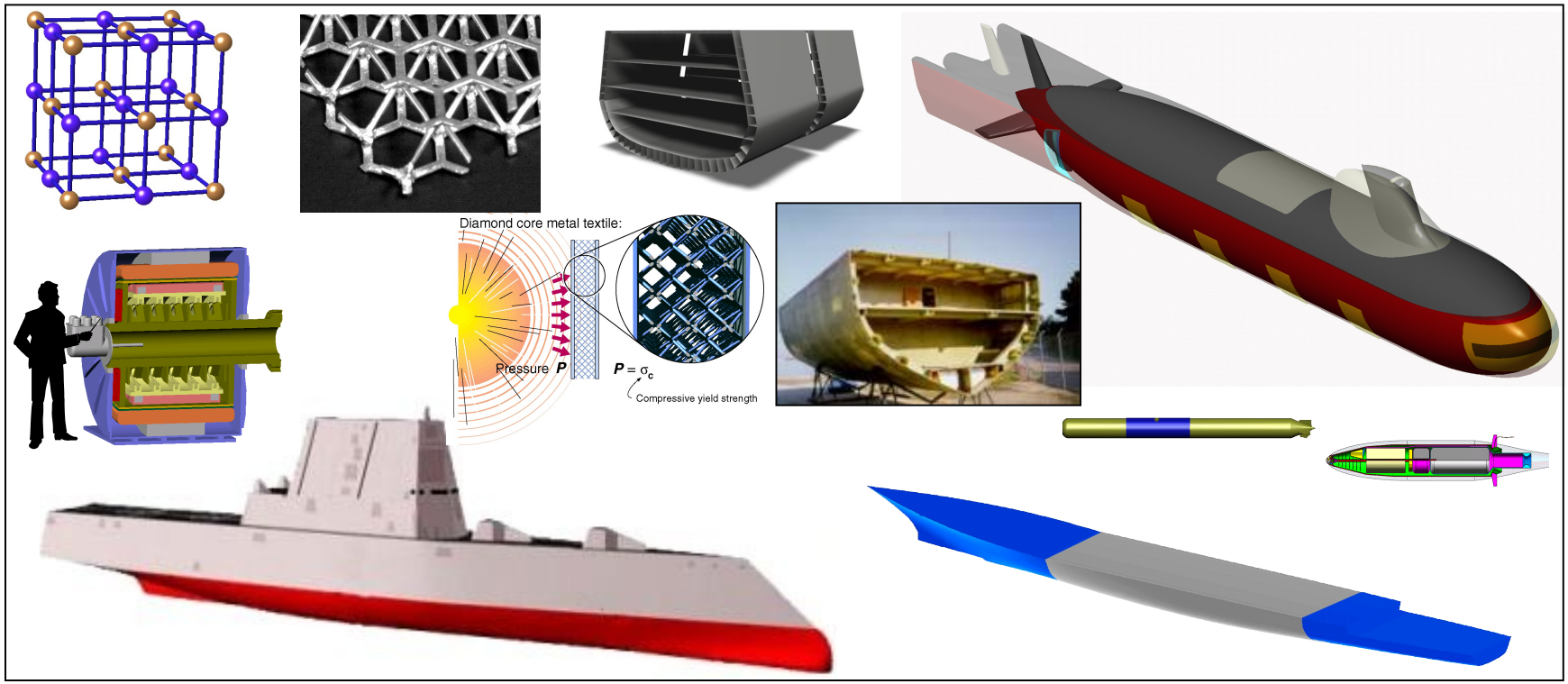
Engineering, Materials & Physical Sciences
Science & Technology Department – ONR 33

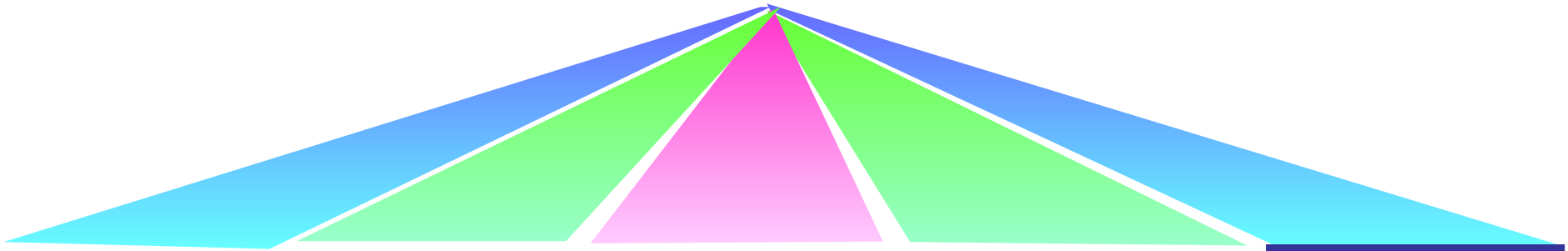


OVERVIEW

Deputy Department Head (Acting),
Engineering, Materials & Physical Sciences S&T Dept (ONR 33)

Code 33 Department Structure

Head (Acting)
Deputy (Acting)



Physical Sciences S&T Division ONR 331	Materials S&T Division ONR 332	Mechanics & Energy Conversion S&T Division ONR 333	Ship Hull, Mechanical & Electrical Systems S&T Division ONR 334	Naval Ship S&T Office ONR 33X

Code 33 Research Thrusts

- Environmental Quality
- Novel Power & Energy Transfer
- Structural Materials
- Functional Materials
- Maintenance Reduction Technologies
- Undersea Weaponry
- Energetic Materials & Energy Conversion
- Hydromechanics
- Reduced Signatures
- Advanced Electrical Power Systems
- Hull Life Assurance
- Distributed Intelligence for Automated Survivability

FROM NANOSTRUCTURES TO AIRCRAFT CARRIERS

S&T Thrust Objectives

Environmental Quality

- Reduce hull fouling through fouling resistant or release coatings
- Increase efficiency and reduce the cost of “black” and “gray” water processing and discharge
- Improve effectiveness and reduce the cost of waste treatment
- Reduce regulated platform emissions
- Reduce far field jet noise

Novel Power & Energy Transfer

- Develop and improve efficiency of solid state conversion concepts to enable direct energy conversion
- Improve the effectiveness of thermal management materials and methodologies
- Increase the densities and efficiencies of power/energy storage and transfer media
- Enable pulse power sources and directed energy applications

S&T Thrust Objectives

Non-Linear Dynamics

- Develop understanding and experiments for Chaos Theory applications
- Enable nonlinear applications in the areas of laser arrays and power systems
- Expand the understanding and use of Complexity Theory, particularly in wargaming
- Enable bio-inspired autonomous vehicles

Structural Materials

- Development of high strength, durable, and cost effective Metals, Ceramics, Polymers, and Composites
- Development of improved Ship Hull and Structural Materials focusing on: Deformation & Fracture; Welding & Joining; Damage Prevention; Fire Protection; Ultralight & Multifunctional; Amorphous Steels

Functional Materials

- Development of high-strain Acoustic Transduction Materials
  - Piezoelectric and Magnetostrictive; Ultra High Strain-High Force Actuators

S&T Thrust Objectives

Maintenance Reduction Technology

- Improved Corrosion Control (Marine Environment)
- Reliable Condition Based Maintenance (CBM)
- New Ultra-reliable Materials (Zero Maintenance)
- Improved Turbine Engine Technologies (FNC)
- Improved Tribology understanding

Energetic Materials

- Develop the next generation of energetic materials and energy conversion concepts with superior performance and acceptable sensitivity and safety characteristics
  - Understand, predict and control the behavior of energetic materials and energy conversion processes in warhead and propulsion environments and configurations

Undersea Weaponry

- Develop and demonstrate technologies that contribute to the cost effective neutralization of threat submarine targets by increasing Probability of Kill in all scenarios, effectively countering enemy torpedoes, enabling long range engagements, increasing weapons load-out, and providing multi-platform connectivity.

S&T Thrust Objectives

Hydromechanics

- Develop robust and affordable hydromechanics technology options (concepts) and design capabilities (computational tools and knowledge base) for surface ships and submarines that meet emerging mission requirements in stealth, maneuvering, seakeeping, and littoral operations
  - Fundamental understanding and prediction of flow phenomena
  - Prevent “hydrodynamic surprise”
  - Improve stealth and agility

Advanced Platform Concepts

- Demonstrate novel/advanced hull forms (e.g. high speed hull forms) including seakeeping, operational flexibility, and maneuverability
- Demonstrate ship systems level technologies to enhance warfighting capabilities
- Develop advanced simulation and modeling tools for designing naval platforms including innovative ship concepts
- Develop the basic investment required to ensure the future viability of the naval engineering disciplines

Reduced Signatures

- Maintain affordable, quiet acoustic signatures
- Understand and control underwater electromagnetic signatures
- Reduce above water signatures and improve topside signature control

S&T Thrust Objectives

Hull Life Assurance

- Develop and transition affordable, advanced structural technology for Navy ships
- Improve the understanding and methodologies for the assessment and design of Navy ship structures
- Improve the mechanical performance of hull and structural materials for Navy ships

Distributed Intelligence for Automated Survivability

- Develop and transition affordable, advanced structural technology for Navy ships
- Improve the understanding and methodologies for the assessment and design of Navy ship structures
- Improve the mechanical performance of hull and structural materials for Navy ships

Advanced Electric Power Systems

- Develop increased power and energy density components and systems
- Reduce the size, weight, and cost of electric power systems (10X to 32X)
- Develop increased survivability and reliability through dynamically reconfigurable architecture
- Develop pulse power generation and control for electric weapons